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Mechaicsville, VA 23111
August 11, 2004

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DIVISION OF COMMUNICATIONS
RICHMOND, VA

State Corporation Commission
Attn: Mssrs. Timothy Lough and Larry Kubrock
P.O. Box 1197
Richmond, VA 23218

Dear Mssrs. Lough and Kubrock:

I read in the paper today about SCC involvement in the Dominion Virginia Power's (DVP) effort to increase the amount of underground electrical transmission and/or distribution to reduce effects of natural disasters. Based on the article, I was not sure whether the issue involves underground transmission or distribution cables. At this point DVP and SCC certainly know everything about underground distribution; consequently there should be little need for outside input.

Underground transmission is another matter. As a physicist and polymer scientist, I worked (in about 1967) on a DuPont Company project involving underground transmission of electricity. The bottom line of this work was that there were no economical options for underground transmission, unless the transmission lines had outrageously and unacceptably large capacities. I can neither remember the details of the investigation, nor could I reveal them to you without DuPont permission if I could. As the project died because of the poor economics, DuPont might willingly share the details. I can, however, relate the gist of the problem, in case it will help.

The main problems with underground transmission are: 1)costs related to the production and installation of the cable, 2)costs associated with correcting the phase shift due to reactance of the cable, 3)electrical energy lost in the insulation and 4)dissipation of heat generated in the conductor. The electrical industry has a good mathematical model for exploring these factors. The effects of these problems vary depending on the type of insulation, size of the conductor and distance. Except for limited, special circumstances, no underground system can compete with overhead transmission. The most competitive underground option was a cable in which the insulation was a structural polymer designed with mostly open space, for example like a honeycomb. The open space was filled with pressurized electronegative gas, which has higher electrical strength than, e.g. air. Unfortunately cables designed to eliminate corona in the gas had intolerably high total cost unless their capacities were outrageously high, and cables which allowed corona would not survive use.

Conceivably there are new technologies which might require rethinking the problem. Should this be done, I would like encourage you to make sure that physical reality is given final say. In the project I described above, there was an electrical engineer who wanted to evaluate options based on a "standard insulation thickness" determined for flurocarbon tape/oil insulated cables. This "standard thickness" was grossly inadequate for gas insulated cables where "freedom from corona" was the criterion ultimately required.

I am currently happily retired and not looking for employment. On the other hand, if I, as a volunteer, might help you evaluate options and/or criteria, I am willing to try so long as the effort does not cost me money. Feel free to phone me if you want to discuss this more: 804-730-4212.

Kindest regards,

Hawthorne A. Davis

Hawthorne A. Davis, Ph.D., Retired DuPont Co., Emeritus NC State University